Revised 510(k) Summary
for the Immunetics, Inc.
BacTx® Bacterial Detection Kit

1. SUBMITTER/510(K) HOLDER

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3. DEVICE NAME

Proprietary Name:	BacTx® Bacterial Detection Kit for Detection of Bacteria in Platelets
Common/Usual Name:	Bacterial Detection System
Classification Name:	Bacterial Detection System for platelet transfusion products
Software Version:	1.2.0.8

4. PREDICATE DEVICES

- Verax Medical Incorporated Platelet PGD Test System (BK090028)
- Becton Dickinson Trypticase Soy Agar 5% Sheep Blood Plates (Pre-Amendment)

5. DEVICE DESCRIPTION

The BacTx® Bacterial Detection Kit for detection of bacteria in platelets is a rapid, qualitative, colorimetric assay for the detection of aerobic and anaerobic, Gram-positive and Gram-negative bacteria in pools of up to six (6) units of leukocyte reduced whole blood derived platelets (platelets, leukocytes reduced) that are pooled within four (4) hours of transfusion as a quality control test. The BacTx® Assay System for detection of bacteria in platelets consists of the BacTx® Bacterial Detection Kit, BacTx® Assay Software provided on a laptop computer, and a BacTx® Reader. The BacTx® Reader is connected to the laptop computer by a USB connection.

The BacTx® Assay System detects the presence of peptidoglycan, which is a component of bacterial cell walls in both Gram-positive and Gram-negative bacteria. To carry out the assay, a processed platelet sample is added to a Reaction Tube, which contains lyophilized detection reagent, and the tube is then placed in the BacTx® Reader. If peptidoglycan is present in the sample, an enzymatic reaction is activated and produces a red-colored product. The BacTx® Reader is a photometer which monitors the detection reaction for 30 minutes and is controlled by the BacTx® Assay Software on the laptop computer. Using the provided BacTx® Assay Software, if bacteria are detected within the 30-minute reading time, a "Fail" result appears on the computer screen and is accompanied by an audible alarm; otherwise, a "Pass" result will be displayed.

6. INDICATIONS FOR USE/INTENDED USE

The Immunetics BacTx® Bacterial Detection Kit for detection of bacteria in platelets is a rapid, qualitative, colorimetric assay for the detection of aerobic and anaerobic, Gram-positive and Gram-negative bacteria in pools of up to six (6) units of leukocyte reduced whole blood derived platelets (Platelets, Leukocytes Reduced) that are pooled within four (4) hours of transfusion as a quality control test.

7. SUMMARY OF TECHNOLOGICAL CHARACTERISTICS COMPARED TO THE PREDICATE DEVICE/S

The intended use of the Immunetics BacTx® Bacterial Detection Kit, blood agar plates and the Verax Platelet PGD Test are identical in that they are all intended for in vitro use for the detection of aerobic and anaerobic, Gram-positive and Gram-negative bacteria in pools of up to six (6) units of leukocyte reduced whole blood derived platelets that are pooled within four (4) hours of transfusion as a quality control test. The Verax Platelet PGD Test has additional FDA clearance as an adjunct quality control test of leukocyte reduced apheresis platelets and as a quality control test of pools of up to six (6) units of non-leukocyte reduced whole blood derived platelets. Blood agar plates are not intended

as a rapid detection method for bacterial contamination and require overnight incubation for detection of Gram-positive and Gram-negative, aerobic and anaerobic bacteria. As a pre-amendment device, blood agar plates can be used for both apheresis and whole blood derived platelets.

While the Immunetics BacTx® Bacterial Detection Kit, Verax Platelet PGD Test, and blood agar plates all detect the presence of bacteria in Leukoreduced Whole Blood Derived Platelets, these three methods differ in their detection technologies. Both the BacTx® Bacterial Detection Kit and Verax Platelet PGD Test are rapid assays that detect components of bacterial cell walls. The Immunetics BacTx® Test is an enzyme-based colorimetric assay which utilizes the prophenoloxidase cascade present in insect larval plasma to detect peptidoglycan in prepared platelet samples and the Verax Platelet PGD Test is a lateral-flow immunoassay that detects lipoteichoic acids and lipopolysaccharides. In contrast, blood agar plates are a culture-based method, which uses a nutrient rich solid medium to facilitate growth of bacterial colonies after incubation at elevated temperatures for 18-24 hours, and is not intended as a rapid test.

8. SUMMARY OF NON-CLINICAL PERFORMANCE TESTING AS BASIS FOR SUBSTANTIAL EQUIVALENCE

A series of non-clinical studies were performed to evaluate the performance of BacTx® Bacterial Detection Kit. These studies included Prozone (Hook effect) testing, interfering substances and immunoassay interfering substances. The results of all studies demonstrated that the BacTx® Bacterial Detection Kit performed according to its specifications.

9. SUMMARY OF CLINICAL TESTING AS BASIS FOR SUBSTANTIAL EQUIVALENCE

Clinical testing was performed at two external sites to assess the analytical sensitivity, reproducibility, time-to-detection, and specificity of the BacTx® Bacterial Detection Kit with pooled, leukoreduced, whole blood derived platelets. The ten bacterial strains used for the analytical sensitivity, reproducibility, and time-to-detection studies are listed in Table 1.

Table 1. Bacterial Strains for Clinical Testing			
Strain	ATCC#	Aerobe or Anaerobe	Gram Positive (GP) or Negative (GN)
Escherichia coli	25922	Aerobe	GN
Pseudomonas aeruginosa	27853	Aerobe	GN
Klebsiella oxytoca	43863	Aerobe	GN
Serratia marcescens	43862	Aerobe	GN
Bacillus cereus	11778	Aerobe	GP
Staphylococcus aureus	27217	Aerobe	GP
Staphylococcus epidermidis	49134	Aerobe	GP
Streptococcus agalactiae	12386	Aerobe	GP
Propionibacterium acnes	11827	Anaerobe	GP
Clostridium perfringens	3629	Anaerobe	GP

Analytical Sensitivity:

The analytical sensitivity (limit of detection) of the BacTx® Assay was determined for each of the 10 species of bacteria listed in Table 1. Four lots of BacTx® kits were used during the analytical sensitivity testing. Bacteria were spiked into pooled platelets at estimated concentrations between 1×10^3 CFU/mL and 1×10^5 CFU/mL. The actual titer was confirmed by quantitative plate culture. The lowest bacterial concentration at which 10 out of 10 replicates of the BacTx® Assay were positive for bacterial contamination (i.e. 10 out of 10 "FAIL" results) was recorded, and the higher value between the two clinical sites was taken to be the limit of detection. These results are shown in Table 2.

Table 2. Analytical Sensitivity Results		
Species	**ATCC Number**	**Limit of Detection (CFU/mL)**
Escherichia coli	25922	8.7×10^3
Pseudomonas aeruginosa	27853	5.0×10^4
Klebsiella oxytoca	43863	9.9×10^3
Serratia marcescens	43862	5.8×10^4
Bacillus cereus	11778	1.7×10^3
Staphylococcus aureus	27217	4.0×10^3
Staphylococcus epidermidis	49134	2.4×10^3
Streptococcus agalactiae	12386	2.7×10^4
Clostridium perfringens	3629	4.5×10^3
Propionibacterium acnes	11827	7.2×10^3

Reproducibility:

Reproducibility of the BacTx® Assay kit was determined between lots and sites using a test panel containing each of the ten bacterial strains listed in Table 1 at concentrations between 0.5 – 1.5 logs above the limit of detection for each strain and a negative sample. Testing was conducted on three different days using different platelet pools and three different kit lots. The test panel members and results of this study are summarized in Table 3.

Table 3. Reproducibility Panel and Results

Sample ID	Logs Above Limit of Detection	# Detected (out of 36)	Detection Rate
Escherichia coli	1.0	36	100%
Staphylococcus aureus	1.2	36	100%
Bacillus cereus	1.4	36	100%
Staphylococcus epidermidis	1.0	36	100%
Klebsiella oxytoca	1.2	36	100%
Pseudomonas aeruginosa	0.8	36	100%
Streptococcus agalactiae	1.2	36	100%
Serratia marcescens	1.2	36	100%
Clostridium perfringens	0.8	36	100%
Proprionibacterium acnes	1.2	36	100%

All 360 bacterial panel members were successfully detected with the BacTx® Assay, and the expected BacTx® result was observed with 395 out of 396 samples overall. No statistically significant difference in reproducibility was observed between the three sites or between the three lots (p=1.0, Fisher-Freeman-Halton test).

Time-To-Detection:

To determine the time to detection of bacteria growing in individual platelet units, low titers (0.6 - 5.0 CFU/mL) of bacteria were spiked into individual units and incubated on a platelet shaker for 7 days. Platelet units spiked with sterile PBS were used as a negative control and also incubated for the 7 days. At approximately 48 hours after inoculation, a small volume of platelets was withdrawn from the contaminated and uncontaminated units. These volumes were each combined with volumes from 5 other sterile LR-RDP units in order to create contaminated and uncontaminated platelet pools, respectively. Ten samples from the contaminated pool and three samples from the uncontaminated pool

were blinded and tested with the BacTx® Assay. If less than 10 of the contaminated samples were detected at the 48 hour time point, this testing was repeated at approximately 72 hours after inoculation. All units were tested at approximately 7 days after inoculation. When BacTx® testing was performed, quantitative plate culture was carried out to determine the bacterial titer in the contaminated pool at that time point. Culture plates made at 24 hours and 7 days after inoculation from the spiked units were submitted for bacterial identification to confirm the strain that proliferated in the unit was the same as the strain that was inoculated. Testing was conducted at the two clinical sites with multiple lots of BacTx® Assay kits. The results of this study are shown in Table 4.

Table 4. Summary of Time-to-Detection Study

Type	Species	Site	Bacterial Titer in unit at inoculation (CFU/mL)	48 hours after Inoculation		72 hours after Inoculation		168 hours after Inoculation	
				# Detected by BacTx® Assay (out of 10)	Bacterial Titer in Pool (CFU/mL)	# Detected by BacTx® Assay (out of 10)	Bacterial Titer in Pool (CFU/mL)	# Detected by BacTx® Assay (out of 10)	Bacterial Titer in Pool (CFU/mL)
Aerobe	*Escherichia coli*	1	1.9	10	$1.8x10^7$	--	--	10	$2.6x10^7$
		2	5.0	10	$6.5x10^7$	--	--	10	$6.0x10^7$
	Pseudomonas aeruginosa	1	2.2	10	$5.2x10^6$	--	--	10	$4.0x10^7$
		2	2.0	10	$1.2x10^6$	--	--	10	$1.9x10^8$
	Klebsiella oxytoca	1	2.0	10	$2.8x10^7$	--	--	10	$1.5x10^7$
		2	3.5	10	$9.9x10^7$	--	--	10	$1.9x10^7$
	Serratia marcescens	1	0.7	10	$3.5x10^8$	--	--	10	$3.0x10^8$
		2	2.0	10	$7.5x10^7$	--	--	10	$2.6x10^8$
	Bacillus cereus	1	1.8	10	$3.6x10^5$	--	--	10	$5.4x10^5$
		2	3.7	10	$5.4x10^6$	--	--	10	$8.9x10^5$
	Staphylococcus aureus	1	3.4	10	$1.0x10^7$	--	--	10	$5.6x10^7$
		2	2.0	10	$8.7x10^6$	--	--	10	$7.0x10^7$
	Staphylococcus epidermidis	1	2.7	9	$6.6x10^2$	10	$2.9x10^4$	10	$1.5x10^7$
		2	3.4	10	$7.0x10^4$	--	--	10	$5.5x10^7$
	Streptococcus agalactiae	1*	0.8	10	$8.7x10^2$	--	--	10	$6.2x10^6$
		2	2.1	10	$3.6x10^6$	--	--	10	$4.9x10^6$
Anaerobe	*Proprionibacterium acnes*	1	0.6	0	0	0	0	0	0
		2	2.3	0	0	0	0	0	0
	Clostridium perfringens	1	4.7	0	0	0	0	0	0
		2	3.7	0	0	0	0	0	0

*Second of two TTD studies performed at Site 1 with *S. agalactiae*. In the first attempt, *S. agalactiae* did not readily proliferate in the platelet unit, with measured titers of 60 and 660 CFU/mL at 48 and 72 hours after inoculation, respectively. A Time-to-Detection within the 5 day shelf-life of the platelet unit could not be determined and this study was repeated. The first timepoint at which 10 out of 10 samples were detected by the BacTx® Assay is shaded in grey.

Of the eight aerobic strains tested, seven of the strains were detected at 48 hours, with 159 of the 160 contaminated platelet detected by the BacTx® Assay at this timepoint. All 10 samples of the contaminated pool containing *S. epidermidis* were detected at the 72 hour timepoint. Neither of the two anaerobes tested (*C. perfringens* and *P. acnes*) exhibited any detectable growth in the aerobic environment of the platelet unit over the 7 day study, and were not detected by the BacTx® Assay. Based on these results, the time to detect all eight aerobes is 72 hours after collection.

Specificity:

Specificity of the BacTx® Assay was tested at two external sites using three lots of BacTx® Assay kits and 432 unique, 6-unit platelet pools. Sterility of the platelet pools was confirmed sterile by plate culture. Out of the 432 BacTx® Assays, 431 were negative for the presence of bacteria in the BacTx® Assay (i.e. a "PASS" result), corresponding to a specificity of 99.8% (with a lower one-sided 95% confidence limit of 99.0%).

10. SUMMARY OF OTHER INFORMATION

This submission included comparison of intended use statements, proposed product labeling and summary information and labeling on predicate devices.

11. CONCLUSIONS DRAWN FROM NON-CLINICAL AND CLINICAL TESTS

Based on the information provided in this 510(k), Immunetics believes that the proposed Immunetics BacTx® Bacterial Detection Kit is substantially equivalent to the previously cleared Verax Platelet PGD Test, and the pre-amendment blood agar plates. The proposed device raises no new issues of safety and effectiveness. The non-clinical and clinical testing performed demonstrates that the proposed device met all test specifications and is suitable for its intended use.